Citation:

Ding EL, Hutfless SM, Ding X, Girotra S. Chocolate and prevention of cardiovascular disease: A systematic review. *Nutr Metab (Lond)*. 2006 Jan 3; 3: 2.

PubMed ID: 16390538

Study Design:

Meta-analysis or Systematic Review

Class:

M - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

➕ POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- To comprehensively evaluate the experimental and epidemiologic evidence of cocoa and chocolate products
- To evaluate the controversial potential benefits of the chocolate components stearic acid and flavonoids; reviews their overall effects on cardiovascular disease (CVD) risk factor intermediates and CVD endpoints; and conduct a meta-analysis of total flavonoid intake and risk of coronary heart disease (CHD) mortality.

Inclusion Criteria:

- Reviewed English-language MEDLINE publications from January 1965 through June 2005 for experimental, observational and clinical studies of relations between the exposure search terms of chocolate, stearic acid, flavonoids (including flavonols, flavanols, catechins, epicatechins and procynadins) and the outcome search terms of cardiovascular disease (coronary heart disease, ischemic heart disease, stroke), cholesterol, blood pressure, platelet, oxidation and thrombosis
- Mainly focused on studies in humans, particularly randomized trials of either parallel or crossover design and prospective observational studies
- Since no randomized trials have yet assessed chocolate in relation to definitive CVD outcomes, prospective observational studies evaluating chocolate sub-components and the risk of CVD outcomes were weighted equally in the overall evaluation.

Exclusion Criteria:

None specified.

Description of Study Protocol:

Recruitment

Reviewed English-language MEDLINE publications from January 1965 through June 2005 for experimental, observational and clinical studies.

Design

- Systematic review and meta-analysis
- For overall objective evaluation, the strength of the evidence was evaluated by the design and quality of individual studies, the consistency of findings across studies and the biologic plausibility of possible mechanisms
- Consistent with methods of the outdated prior analysis, an updated meta-analysis was conducted
  and relative risks (RR) estimates pooled using a random-effects model.

Statistical Analysis

RR is reported for the updated meta-analysis.

Data Collection Summary:

Timing of Measurements

English-language MEDLINE publications from 1966 through January 2005.

Dependent Variables

Variable 1:

- Brief description (How was it measured?)
- The risk of cardiovascular disease [coronary heart disease (CHD), stroke].

Independent Variables

Intake of cocoa, cacao, chocolate, stearic acid and flavonoids (including flavonols, flavanols, catechins, epicatechins and procynadins).

Description of Actual Data Sample:

- *Initial N:* Approximately 400 papers were reviewed
- *Attrition (final N):* Based on the relevance, strength and quality of the design and methods, 136 publications were selected for inclusion
- *Location:* Participants from Europe, US, Asia, Australia and the Caribbean.

Summary of Results:

- The body of short-term randomized feeding trials suggests cocoa and chocolate may exert beneficial effects on cardiovascular risk via effects on lowering blood pressure, anti-inflammation, anti-platelet function, higher HDL and decreased LDL oxidation
- A large body of trials of stearic acid suggests it is indeed cholesterol-neutral
- However, epidemiologic studies of serum and dietary stearic acid are inconclusive due to many methodologic limitations

- The large body of prospective studies of flavonoids suggests the flavonoid content of chocolate may reduce risk of cardiovascular mortality. Our updated meta-analysis indicates that intake of flavonoids may lower risk of CHD mortality, RR=0.81 (95% CI: 0.71 to 0.92) comparing highest and lowest tertiles.

Author Conclusion:

- Based upon this systematic review, multiple lines of evidence from laboratory experiments and randomized trials suggest stearic acid may be neutral, while flavonoids are likely protective against CVD, the latter of which is well supported by prospective observational studies that suggest flavonoids may lower the risk of CHD mortality
- Although it has been approximated that eating 50g of dark chocolate per day may reduce one's risk of CVD by 10.5% (95% CI: 7.0% to 13.5%), such crude estimates were based on results from studies of short duration and then extrapolated to long-term CVD outcomes
- Therefore, the highest priority now is to conduct long-term randomized feeding trials, beyond short-term studies of CVD risk factor intermediates, in order to definitively investigate the impact of chocolate consumption on cardiovascular outcomes.

Reviewer Comments:

- *Exclusion criteria is not indicated*
- *Studies varied in the amounts of chocolate and cocoa consumed*
- *I felt the methods of data aggregation were not clearly outlined.*

Research Design and Implementation Criteria Checklist: Review Articles

Relevance Questions

1.	Will the answer if true, have a direct bearing on the health of patients?	Yes
2.	Is the outcome or topic something that patients/clients/population groups would care about?	Yes
3.	Is the problem addressed in the review one that is relevant to nutrition or dietetics practice?	Yes
4.	Will the information, if true, require a change in practice?	Yes

Validity Questions

1.	Was the question for the review clearly focused and appropriate?	Yes
2.	Was the search strategy used to locate relevant studies comprehensive? Were the databases searched and the search terms used described?	Yes
3.	Were explicit methods used to select studies to include in the review? Were inclusion/exclusion criteria specified and appropriate? Were selection methods unbiased?	Yes

4.	Was there an appraisal of the quality and validity of studies included in the review? Were appraisal methods specified, appropriate, and reproducible?	Yes
5.	Were specific treatments/interventions/exposures described? Were treatments similar enough to be combined?	Yes
6.	Was the outcome of interest clearly indicated? Were other potential harms and benefits considered?	Yes
7.	Were processes for data abstraction, synthesis, and analysis described? Were they applied consistently across studies and groups? Was there appropriate use of qualitative and/or quantitative synthesis? Was variation in findings among studies analyzed? Were heterogeneity issued considered? If data from studies were aggregated for meta-analysis, was the procedure described?	Yes
8.	Are the results clearly presented in narrative and/or quantitative terms? If summary statistics are used, are levels of significance and/or confidence intervals included?	Yes
9.	Are conclusions supported by results with biases and limitations taken into consideration? Are limitations of the review identified and discussed?	Yes
10.	Was bias due to the review's funding or sponsorship unlikely?	Yes